MEC 305: Heat and Mass Transfer (Spring 2019)

Instructor: Prof. David Hwang (david.hwang@stonybrook.edu)
222 Heavy Engineering Building
Office Hours: Mon 1pm-4pm (222 Heavy Engineering)

Teaching Assistants: Seungkuk Kuk (in charge of recitation; Seungkuk.Kuk@stonybrook.edu),
and Gaurav Guleria (HW grading; Gaurav.Guleria@stonybrook.edu)

Lectures: MWF 11:00-11:53am (145 ENGINEERING)
Recitation-01: M 09:00-09:53am (101 JAVITS LECTR) – no recitation for week 1
Recitation-02: W 09:00-09:53am (201 HVY ENGR) – no recitation for week 1

Prerequisites: MEC 301 and MEC 364

Course Description The fundamental laws of momentum, heat, and mass transfer, and the corresponding transport coefficients. Principles of steady-state and transient heat conduction in solids are investigated. Laminar and turbulent boundary layer flows are treated, as well as thermal radiation, and radiation heat transfer between surfaces. Applications to heat transfer equipment are covered throughout the course.

Required Text: Yunus Cengel and Afshin Ghajar, *Heat and Mass Transfer: Fundamentals & Applications*, 5th Ed., McGraw-Hill, 2015.

Lecture Note: pdf version will be uploaded on blackboard in advance, but key contents will be partly blanked and will be provided during lecture only. It is recommended that each student print out (e.g., 2, 4 or 6 slides per page as convenient) and fill in advance referring to textbook.

Homework: Homework to be assigned either weekly or biweekly. Assignments will be due by the end of class of the deadline and should be submitted in class, unless otherwise stated. If class cancels on the original due date, the assignment will be due by the end of right next class hour. Late homework will receive half credit until the solutions are posted and will <u>not</u> be accepted after that.

Exams: Two midterms and One final exam. All exams are closed book with cheat sheet(s) of allowed number of pages; subject to change. You must bring your Stony Brook ID and an approved scientific calculator to each exam. No makeup exams, unless arranged <u>prior</u> to the exam.

Grading:
Homework:	15% (due by one week)
Midterm I:	20% (~6th week; TBD)
Midterm II:	20% (~11th week; TBD)
Final (comprehensive):	45% (regular final exam schedule)
Extra credits/Bonus:	+5% (in-class quiz/attendance, subject to change)

*. Subject to minor adjustment. Final grading may be curved (only to improve).
*. <u>Question(s) on graded homework/exam will be accepted only for one week after posting scores.</u>

Course Outline:
1. Basic Concepts of Thermodynamics and Heat Transfer (Chapter 1)
2. Heat Conduction
   - Heat Conduction Equation (Chapter 2)
   - Steady Heat Conduction (Chapter 3)
   - Transient Heat Conduction (Chapter 4)
3. Convection
   - Fundamentals of Convection (Chapter 6)
   - Forced Convection (Chapters 7 and 8)
   - Natural Convection (Chapter 9)
4. Radiation Heat Transfer (Chapters 12 and 13)

Tentative schedule (subject to change, section & chapter numbers are based on textbook):

Date	Day	Topic	HW to be assigned	HW to be submitted
28-Jan	Mon	Introduction, sec 1.1-1.4		
30-Jan	Wed	sec 1.5-1.8		
1-Feb	Fri	sec 1.9 & chap 1 examples	HW #1 (chap 1)	
4-Feb	Mon	sec 2.1-2.2		
6-Feb	Wed	sec 2.3-2.4		
8-Feb	Fri	sec 2.5-2.6	HW #2 (chap 2)	HW #1
11-Feb	Mon	chap 2 examples		
13-Feb	Wed	sec 3.1		
15-Feb	Fri	sec 3.2-3.3	HW #3 (chap 3)	HW #2
18-Feb	Mon	sec 3.4-3.5		
20-Feb	Wed	sec 3.6 & chap 3 examples		
22-Feb	Fri	chap 3 examples		
25-Feb	Mon	catch-up		
27-Feb	Wed	sec 4.1		
1-Mar	Fri	Midterm #1 Review (1)		HW #3
4-Mar	Mon	sec 4.2		
6-Mar	Wed	Midterm #1 Review (2)		
8-Mar	Fri	**Midterm #1 (Chap 1-3) 53 min**	HW #4 (chap 4)	
11-Mar	Mon	sec 4.3		
13-Mar	Wed	chap 4 examples		
15-Mar	Fri	sec 6.1-6.4	Read MEC 364 portion of sec 6.3, 6.5, 6.7-6.10	
18-Mar	Mon	**(No class - Spring Recess)**		
20-Mar	Wed	**(No class - Spring Recess)**		
22-Mar	Fri	**(No class - Spring Recess)**		
25-Mar	Mon	sec 6.7-6.8	HW #5 (chap 6-7)	HW #4
27-Mar	Wed	sec 6.9-6.11		
29-Mar	Fri	sec 6.5-6.6, sec 7.1-7.2		
1-Apr	Mon	chap 6-7 examples		
3-Apr	Wed	catch-up		
5-Apr	Fri	Midterm #2 Review (1), sec 9.1-9.2		HW #5
8-Apr	Mon	sec 9.3, sec 9.6		
10-Apr	Wed	Midterm #2 Review (2)		
12-Apr	Fri	**Midterm #2 (Chap 4, 6, 7) 53 min**		
15-Apr	Mon	sec 8.1-8.4	HW #6 (chap 8-9)	
17-Apr	Wed	sec 8.5		
19-Apr	Fri	chap 8 & 9 examples		
22-Apr	Mon	catch-up		
24-Apr	Wed	sec 12.1-12.3, sec 12.5-12.6		
26-Apr	Fri	chap 12 examples	HW #7 (chap 12-13)	HW #6
29-Apr	Mon	sec 13.1-13.2		
1-May	Wed	sec 13.3-13.5		
3-May	Fri	chap 13 examples		
6-May	Mon	catch-up		
8-May	Wed	Final Review (1)		
10-May	Fri	Final Review (2)		HW #7
16-May	Thu	**Final Exam (comprehensive) 2h30m**	Exam Hour 11:15-1:45 PM	

Course Learning Objectives:

1. Demonstrate the ability to identify the three modes of heat transfer: conduction, convection, and radiation, and solve simple multi-mode heat transfer problem.
2. Demonstrate the ability to formulate and solve the differential equation of heat conduction in various coordinates systems with proper thermal boundary conditions.
3. Demonstrate the ability to develop thermal resistance networks for practical heat conduction problems.
4. Demonstrate the ability to solve transient lumped-parameter heat conduction problems.
5. Demonstrate the ability to analyze convective heat transfer in boundary layer and internal pipe flows based on Newton's law of cooling.
6. Demonstrate the ability to analyze radiative heat transfer between nonblack surfaces.

Blackboard: All homework assignments and solutions will be posted on the Blackboard course account (http://blackboard.sunysb.edu).

All communication off class/office hours will be done exclusively through Blackboard. Blackboard uses your official Stony Brook e-mail address. It is your responsibility to check this e-mail address regularly, so that you do not miss any important announcements.

Allowed Calculators: Following the Mechanical Engineering Department's mandatory calculator policy, only the following calculators will be allowed to be used on the midterm and final exams. There will be no exceptions. This list of calculators is identical to that allowed for the *National Council for Examiners for Engineering and Surveying* (NCEES) Fundamentals of Engineering (FE) exam that many of you will take in your senior year, as well as the Professional Engineering (PE) exam that you may take several years from now. The sooner you become comfortable on one of these calculators, the better.

Casio: All fx-115 models. Any Casio calculator must contain fx-115 in its model name.
Hewlett Packard: The HP 33s and HP 35s models, but no others.
Texas Instruments: All TI-30X and TI-36X models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.

The NCEES policy on calculators can be found here:
http://www.ncees.org/exams/calculators/

Disability Support Services (DSS) Statement: If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: http://www.stonybrook.edu/ehs/fire/disabilities.

Academic Integrity Statement: Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on

academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/.

Critical Incident Management: Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.